

# Enabling the Physics Goals

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on behalf of the Theory Frontier



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Community Summer Study  
SN  WMASS  
2022 July

17-26 Seattle  
Captions here, please!

First drafts of topical group summaries and the frontier summary are available now.

**Frontier and topical group summaries**

<https://bit.ly/3cnOT2Y>



**Feedback on summaries**

<https://bit.ly/3altHEc>



See frontier summary for details on science highlights and goals.

# Goals

- Advance our understanding of Nature by pursuing a broad and balanced program of theoretical research covering the entire spectrum of particle physics, from fundamental to phenomenological to computational theory.
- Connect the frontiers of particle physics and enable the comparison of data across different scales.
- Explore new research directions, incorporate new developments from adjacent fields, and build new bridges to gravity, cosmology, astrophysics, quantum information, nuclear physics, AMO, condensed matter physics, statistics, computer science, data science, and mathematics.



# Goals

- Fulfill the theory needs of current and planned experiments, from motivation to analysis to interpretation, and be responsive to their results.
- Envision and motivate future experiments, and furnish the tools necessary for their success.
- Pursue exploratory research, reflecting theory as a vibrant intellectual endeavor in its own right.



# Goals

- Sustain US leadership in the international theory community.
- Cultivate a vibrant, inclusive, and supportive scientific community, developing “ $4\pi$  coverage” in identifying and fostering talent at all career stages.
- Maintain a program across HEP that trains students and junior scientists, providing them with continuing physics opportunities that empower them to contribute to science.



# Critical Needs

**1. Support for the essential role of theory similar to (and at least as strong as) recommended by the European Strategy Update, both in relation to projects and in its own right.**



**Other essential scientific activities for particle physics**

B. Theoretical physics is an essential driver of particle physics that opens new, daring lines of research, motivates experimental searches and provides the tools needed to fully exploit experimental results. It also plays an important role in capturing the imagination of the public and inspiring young researchers. The success of the field depends on dedicated theoretical work and intense collaboration between the theoretical and experimental communities. ***Europe should continue to vigorously support a broad programme of theoretical research covering the full spectrum of particle physics from abstract to phenomenological topics. The pursuit of new research directions should be encouraged and links with fields such as cosmology, astroparticle physics, and nuclear physics fostered. Both exploratory research and theoretical research with direct impact on experiments should be supported, including recognition for the activity of providing and developing computational tools.***

# Critical Needs

**2. Support for a balanced program of Projects and Research, as both are essential to the health of the field.**

**3. Support for people, especially early career, who are the key “infrastructure” of Research.**

**4. Support for targeted funding advancing the physics goals.**

(E.g. LQCD Project, LHC Theory Initiative, Neutrino Theory Network, QIS, AI/ML, Exascale Computing Project, SciDAC...)





**Thank you!**



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